

REMARKS

The above amendment is made in response to the Final Office action mailed June 5, 2008. The Examiner's reconsideration is respectfully requested in view of the above amendment and the following remarks.

Claims 1-4, 7 and 8 have been amended to more clearly define the subject matter of the claimed invention. Claims 5, 6 and 9-16 have been canceled, without prejudice. No new matter has been introduced by these amendments.

Claims 1-4, 7 and 8 are thus pending in the present application.

Claim Rejections Under 35 U.S.C. §112

Claims 3, 4 and 11-13 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claiming the subject matter which the applicant regards as his invention. The Examiner has stated, regarding Claims 3, 4 and 11-13, that the limitations "preparing an alloy of a primary metal and a secondary metal" and "to form an alloy-catalyst" are not supported by the specification.

Applicants have cancelled Claims 11-13.

Applicants submit that the limitations "preparing an alloy of a primary metal and a secondary metal" and "to form an alloy-catalyst" are supported by the specification as originally filed, for example, lines 8-13 and 19-25 on page 14; lines 14-17 on page 15; and lines 3-5 and 18-19 on page 31 of the specification. It is noted that, in the previous response filed on March 27, 2008, page 15, line 2 – page 16, line 12 of the specification was pointed to support the two-step reduction process. Applicants apologize for the confusion.

Applicants respectfully request the Examiner to review these submissions and withdraw the rejection on Claims 3, 4 and 11-13 under 35 U.S.C. §112, second paragraph.

Claim Rejections Under 35 U.S.C. §103

Rejection on Claims 1, 2, 9 and 10

Claims 1, 2, 9 and 10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Baker et al. (US 2002/0054849; hereinafter, “Baker ’849”).

In order for an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996). See MPEP 2143.

Establishing a prima facie case of obviousness requires that all elements of the invention be disclosed in the prior art. *In re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). Further, even assuming that all elements of an invention are disclosed in the prior art, an Examiner cannot establish obviousness by locating references that describe various aspects of a patent applicant's invention without also providing evidence of the motivating force which would have impelled one skilled in the art to do what the patent applicant has done. *Ex parte Levengood*, 28 U.S.P.Q. 1300 (Bd. Pat. App. Int. 1993). The references, when viewed by themselves and not in retrospect, must suggest the invention. *In re Skill*, 187 U.S.P.Q. 481 (C.C.P.A. 1975).

Applicants have amended Claims 1 and 2 to correct clerical errors. Claims 9 and 10 have been cancelled.

The amended Claims 1 and 2 include, *inter alia*, the following limitation:

"having two directional growth axis to grow two units of carbon nanofibers" and
"the two unit carbon nanofibers are combined by inter-fiber force or van der Waals force, forming pair structure as a single body"

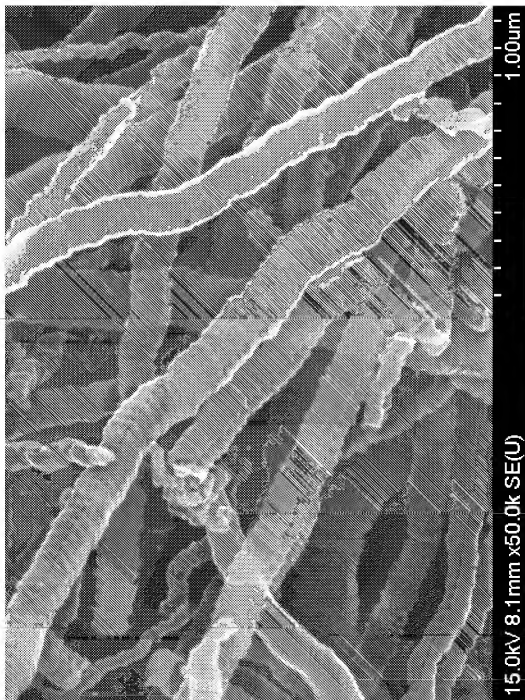
As above, the claimed fibrous nanocarbon includes two units of carbon nanofibers, which are grown along two directional growth axis. Further, the two unit nanofibers are combined to form pair structure as a single body, as shown in modeled diagrams of Figs. 4 and 13, and Figs. 8 and 9A of this application. Applicants present further SEM photographs showing applicant's pair-structured fibrous nanocarbons (see SEM photographs A and B on pages 9 and 10 of this paper).

Baker '849 is directed to a process for producing crystalline carbon nanofibers where the graphite sheets are grown in parallel to the longitudinal axis of the fiber. However, Baker '849 is silent about applicant's pair-structure formed of two unit fibers. Further, Applicants respectfully note that this pair-structural feature (as recited in Claims 1 and 2) is not addressed in the Examiner's reasons for rejection regarding Claims 1 and 2.

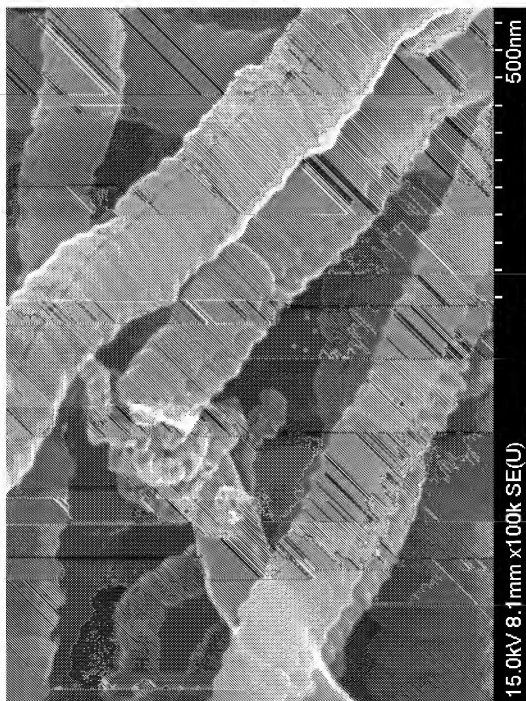
Therefore, it is submitted that Baker '849 fails to teach or suggest the subject matter claimed in Claims 1 and 2, and thus *no suggestion or motivation* exists in the cited reference. Accordingly, *prime facie* obviousness does not exist regarding the subject matter claimed in Claims 1 and 2 with respect to the cited reference. Applicants respectfully submit that Claims 1 and 2 are allowable over Baker '849.

Applicants respectfully request the Examiner to review these submissions and withdraw the rejection on Claims 1 and 2 under 35 U.S.C. §103(a).

SEM Photograph A



SEM Photograph B



Rejection on Claims 3-8 and 11-16

Claims 3-8 and 11-16 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Baker '849 in view of Baker, et al. (U.S. Patent 5,458,784; hereinafter "Baker '784") and Resasco (U.S. Patent Application Publication No. 2002/0131910).

Applicants have amended Claims 3 and 4 to more clearly define the subject matter of the claimed invention. Claims 5 and 6 have been cancelled, of which subject matter is incorporated into Claims 3 and 4 respectively. Claims 7 and 8 have been amended to change their dependency due to cancellation of Claims 5 and 6. Claims 11-16 have been cancelled.

Claims 3 and 4 are independent, and Claims 7 and 8 are dependent directly from Claims 3 and 4 respectively.

Claim 3 is drawn to a preparation method of fibrous nanocarbon of Claim 1, and Claim 4 to a preparation method of fibrous nanocarbon of Claim 2.

The amended Claims 3 and 4 include, *inter alia*, the following limitation:

wherein the catalyst is prepared by the steps comprising of: preparing an alloy of primary metal and secondary metal; reducing the alloy to form an alloy-catalyst; cooling the alloy-catalyst for passivation; reducing the cooled alloy-catalyst at the temperature ranges of 450~550°C under the hydrogen-helium mixed gases containing 1~40v/v % hydrogen; and reacting the reduced alloy-catalyst with the gaseous or liquid carbon sources, and

wherein transition metals such as Fe, Ni or Co active to said carbon sources are used as primary metals; to assist dispersion of said primary metals, the addition of 5 to 95 wt % secondary metals inactive to said carbon sources results in formation of fine particle catalyst; and hydrocarbon/hydrogen gas mixtures containing 2 to 95v/v % hydrogen are introduced over said fine particle catalyst at the rate of 0.5 to 30 sccm per 1 mg catalyst at the temperatures of 380 to 750°C for the reaction time of 2 min to 48 h

As above, in the claimed invention, an alloy of primary metal and secondary metal are prepared and the alloy is reduced to form an alloy-catalyst. Further, transition metals such as Fe, Ni or Co active to carbon sources are used as the primary metal, and the addition of 5 to 95 wt% secondary metals inactive to the carbon source is reduced at a temperature range of 450 to 550°C under a gas mixture of hydrogen and helium to thereby form a fine particle bimetallic

alloy-catalyst. Furthermore, hydrocarbon/hydrogen gas mixtures containing 2 to 95 v/v% hydrogen are introduced over the fine particle catalyst at the rate of 0.5 to 30 sccm per 1mg catalyst at the temperatures of 380 to 750 °C for 2 min to 48 hours. Under these reaction conditions, (i.e., the specific ratio of primary and secondary metals, specific reaction temperature and time, the specific gaseous atmosphere and gas amount, and the like), two units of carbon nanofibers can be formed and grown along two-independent axes so as to form a pair structure comprised of the two units of carbon nanofibers combined by inter-fiber force or van der Waals force as a single body.

In Baker '849, catalyst powders are prepared by co-precipitation of aqueous solution containing iron and either copper or nickel at a ratio of about 1:99 to about 99:1 using bicarbonate ammonium. The resultant precipitates are dried and calcinated in air at 400°C. The calcinated powders are reduced in hydrogen for 20 hours at 400°C. In Baker '748, catalyst is reduced in a 10% hydrogen helium atmosphere. In Resasco, catalytic particles with a Co:Mo molar ratio of about 1:2 is pre-reduced in hydrogen at 500°C.

Applicants respectfully submit that Baker '849, Baker '748 and Resasco, either alone or in combination, do not teach or suggest the specific ratio of primary and secondary metals, specific reaction temperature and time, specific gaseous atmosphere and gas amount, as recited in Claims 3 and 4, by which two units of carbon nanofibers can be formed and grown along two-independent axes so as to form a pair structure comprised of the two units of carbon nanofibers combined by inter-fiber force or van der Waals force as a single body.

It is therefore submitted that Baker '849, Baker '748 and Resasco, either alone or in combination, fail to teach or suggest the subject matter claimed in amended Claims 3 and 4, and thus *no suggestion or motivation* exists in the cited references. Accordingly, *prime facie* obviousness does not exist regarding the subject matter claimed in Claims 3 and 4 with respect to the cited references. Applicants respectfully submit that Claims 3 and 4 are now allowable over the prior art of record. Claims 7 and 8 are also believed to be allowable, by virtue of their direct dependency from Claim 3 and 4 respectively.

Applicants respectfully request the Examiner to review these submissions and withdraw the rejection on Claims 3-8 and 11-16 under 35 U.S.C. §103(a).

Conclusion

In view of the foregoing, it is respectfully submitted that the instant application is in condition for allowance. Reconsideration and subsequent allowance of this application are courteously requested.

If there are any charges due with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicant's attorneys.

The Examiner is invited to contact Applicant's Attorneys at the below-listed telephone number with any questions or comments regarding this Response or otherwise concerning the present application.

Respectfully submitted,

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